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(54) **Fabric treatment composition.**

(57) A fabric treatment composition comprising an aqueous base, one or more, fabric-softening materials and an emulsion component, said composition having a structure of lamellar droplets of the fabric-softening material in combination with an emulsion, said composition also comprising a deflocculating polymer comprising a hydrophilic backbone and one or more hydrophobic side chains.
The deflocculating polymer allows the incorporation of greater amounts of softening materials and/or emulsion components that would otherwise be compatible with the need for a stable, easily dispersible product of acceptable viscosity.

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The present invention relates to fabric treatment compositions in aqueous medium and containing a relatively high proportion of fabric conditioner. In particular, the present invention relates to fabric treatment compositions which comprise as conditioners one or more fabric-softening materials and one or more emulsion forming components to result in a structure of a dispersion of an emulsion and a dispersion of lamellar droplets in a continuous aqueous phase.

Lamellar droplets are a particular class of surfactant structures which, *inter alia*, are already known from a variety of references, e.g. H.A. Barnes, 'Detergents', Ch.2. in K. Walters (Ed), 'Rheometry: Industrial Applications', J. Wiley & Sons, Letchworth 1980.

Lamellar fabric-softening compositions are for example known from EP 303 473 (Albright and Wilson). This patent application describes fabric-softening compositions comprising an aqueous base, a cationic fabric softener having two long alkyl or alkenyl groups and dissolved electrolyte to form an optically anisotropic spherulitic composition.

The presence of lamellar droplets in a fabric-softening product may be detected by means known to those skilled in the art, for example optical techniques, various rheometrical measurements, X-ray or neutron diffraction, and electron microscopy.

The droplets consist of an onion-like configuration of concentric bi-layers of molecules of fabric-softening material, between which is trapped water or electrolyte solution (aqueous phase). Systems in which such droplets are nearly or fully close-packed provide a very desirable combination of physical stability and useful flow properties.

It is desirable to add other components to fabric softening compositions in the form of emulsions in the aqueous phase, to provide added benefits such as crease reduction and ease of ironing as well as improving softening. For example hydrocarbons such as mineral oils which give added softening and lubricating effects when applied to textile fibres and fabrics, perfume emulsions and solutions of perfumes in carrier emulsions.

In the past it has been recognised that certain stability problems arise when hydrocarbons are added to a dispersion of fabric softening material. For example in GB 1 601 360 (Procter and Gamble Co/Goffinet) certain textile treatment compositions are disclosed comprising a water insoluble cationic fabric softener, a hydrocarbon and a relatively high proportion of a cationic surfactant which is water soluble. It is believed that such water soluble surfactants are not lamellar phase forming and are present to solubilise the hydrocarbon. Such compositions can still suffer from high viscosity. In EP 13 780 (Procter and Gamble/Verbruggen) low levels of non-cyclic hydrocarbons or fatty acids are suggested as viscosity control aids in compositions comprising up to 20% of certain imidazolinium salts. There is no disclosure of how to incorporate higher levels of the hydrocarbon or fatty acid without encountering viscosity problems.

It is believed that the presence of the lamellar dispersion of fabric softening material can flocculate the emulsion component by a mechanism of depletion. This phenomenon is well known in mixed disperse systems and in systems containing either a structured surfactant phase or a non-adsorbed polymer for example D. Fairhurst, M. Aronson, M. Gun and E. Goddard *Colloids Surf.* 1983, 7, 153. This depletion flocculation leads to increases in the viscosity of the fabric treatment composition due to reduction of the inter-particle spacings.

There are two main factors determining the viscosity and stability of the fabric softening composition, the combined volume fraction of the dispersed lamellar phase and the emulsion and their state of aggregation. Generally speaking, the higher the volume fraction of the dispersed lamellar phase (droplets) and emulsion phase (particles), the higher the viscosity which in the limit can result in an unpourable or gelled product. When the volume fraction is around 0.6, or higher, the droplets are just touching (space-filling). This allows reasonable stability with an acceptable viscosity (say no more than 2.5 Pas, preferably no more than 1 Pas most preferably no more than 0.5 Pas at a shear rate of 21s^{-1}). However, flocculation of the particles can also occur. As previously explained, the lamellar dispersion can cause depletion flocculation of the emulsion component. Flocculation of either the lamellar dispersion or the emulsion can lead to instability because reduction of the inter-particle inter-droplet spacings will make their packing more efficient. Consequently, more lamellar droplets or emulsion will be required for stabilisation which will again lead to a further increase of the viscosity.

The volume fraction of the droplets is increased by increasing the softener concentration, and may be reduced by increasing the electrolyte level. However, the stability of the emulsion component is very sensitive to electrolyte levels. When electrolyte is added to an emulsion it reduces the effects of depletion but the levels required to prevent depletion are sufficient to cause flocculation of the emulsion by an electrostatic mechanism and thus the problem is not solved.

Thus, in practice, there are limits to the amounts of fabric softening material, emulsion component and optionally electrolyte which can be incorporated whilst still having an acceptable product. In principle, higher levels of fabric softening materials are desired for convenience and for reduction of costs, the presence of emulsion components are desired for providing added benefits such as fabric lubrication and perfume delivery and certain levels of electrolyte are desired to give, in certain circumstances, better delivery and anionic carry-over

protection.

We have now found that the dependency of stability and/or viscosity upon the volume fraction of softening material and the volume fraction of the emulsion component can be favourably influenced by incorporating into the compositions a deflocculating polymer comprising a hydrophilic backbone and one or more hydrophobic side chains.

Accordingly, the present invention relates to a fabric treatment composition comprising an aqueous base, one or more fabric-softening materials, and an emulsion component, said composition having a structure of lamellar droplets of the fabric-softening material in combination with an emulsion, said composition also comprising a deflocculating polymer comprising a hydrophilic backbone and one or more hydrophobic side chains.

The deflocculating polymer allows, if desired, the incorporation of greater amounts of softening materials and/or emulsion components than would otherwise be compatible with the need for a stable, easily dispersible product of acceptable viscosity. It also allows (if desired) incorporation of greater amounts of certain other ingredients to which lamellar dispersions and emulsions have been highly stability-sensitive.

The present invention allows formulation of stable, pourable products wherein the volume fraction of the lamellar droplets and the emulsion is 0.5 or higher.

The volume fraction of the lamellar droplet phase and emulsion component may be determined by the following method. The composition is centrifuged, say at 40,000 G for 12 hours, to separate the composition into a clear (continuous aqueous) layer, a turbid active-rich (lamellar/emulsion) layer and (if solids or liquids are suspended) a third layer. The conductivity of the continuous aqueous phase, the lamellar phase and of the total composition before centrifugation are measured. From these, the volume fraction of the lamellar phase and emulsion component is calculated or estimated, using the Bruggeman equation, as disclosed in American Physics, 24, 636 (1935). The volume fraction of the emulsion component can be calculated if desired, provided the density is known and the volume fraction of the lamellar phase calculated.

Preferably, the viscosity of the aqueous continuous phase is less than 25 mPas, most preferably less than 15 mPas, especially less than 10 mPas, these viscosities being measured using a capillary viscometer, for example an Ostwald viscometer.

In practical terms, i.e. as determining product properties, the term 'deflocculating' in respect of the polymer means that the equivalent composition, minus the polymer, has a significantly higher viscosity and/or becomes unstable. It is not intended to embrace the use of polymers which would increase the viscosity but not enhance the stability of the composition. It is also not intended to embrace polymers which would lower the viscosity simply by a dilution effect, i.e. only by adding to the volume of the continuous phase. Although within the ambit of the present invention, relatively high levels of the deflocculating polymers can be used in those systems where a viscosity reduction is brought about; typically levels as low as from about 0.01% by weight to about 5.0% by weight can be capable of reducing the viscosity at 21 s^{-1} by up to 2 orders of magnitude.

Especially preferred embodiments of the present invention exhibit less phase separation on storage and have a lower viscosity than an equivalent composition without any of the deflocculating polymer.

In the context of the present invention, stability for these systems can be defined in terms of the maximum separation compatible with most manufacturing and retail requirements. That is, the 'stable' compositions will yield no more than 2% by volume phase separation as evidenced by appearance of 2 or more separate phases when stored at 25°C for 21 days from the time of preparation.

In the case of the compositions where the combined lamellar/emulsion phase volume fraction is 0.5 or greater, it is not always easy to apply this definition. In the case of the present invention, such systems may be stable or unstable, according to whether or not the droplets or particles are flocculated. For those that are unstable, i.e. flocculated, the degree of phase separation may be relatively small, e.g. as for the unstable non-flocculated systems with the lower volume fraction. However, in this case the phase separation will often not manifest itself by the appearance of a distinct layer of continuous phase but will appear distributed as 'cracks' throughout the product. The onset of these cracks appearing and the volume of the material they contain are almost impossible to measure to a very high degree of accuracy. However, those skilled in the art will be able to ascertain instability because the presence of a distributed separate phase greater than 2% by volume of the total composition will readily be visually identifiable by such persons. Thus, in formal terms, the above-mentioned definition of 'stable' is also applicable in these situations, but disregarding the requirement for the phase separation to appear as separate layers.

Especially preferred embodiments of the present invention yield less than 0.1% by volume visible phase separation after storage at 25°C for 21 days from the time of preparation.

However, it is usually possible to obtain a figure which, whilst approximate, is still sufficient to indicate the effect of the deflocculating polymer in the compositions according to the present invention. Where this difficulty arises in the compositions exemplified hereinbelow, it is indicated accordingly.

The compositions according to the invention may contain only one, or a mixture of deflocculating polymer

types. The term 'polymer types' is used because, in practice, nearly all polymer samples will have a spectrum of structures and molecular weights and often impurities. Thus, any structure of deflocculation polymers described in this specification refers to polymers which are believed to be effective for deflocculation purposes as defined hereabove. In practice these effective polymers may constitute only part of the polymer sample, provided that the amount of deflocculation polymer in total is sufficient to effect the desired deflocculation effects. Furthermore, any structure described herein for an individual polymer type, refers to the structure of the predominant deflocculating polymer species and the molecular weight specified is the weight average molecular weight of the deflocculation polymers.

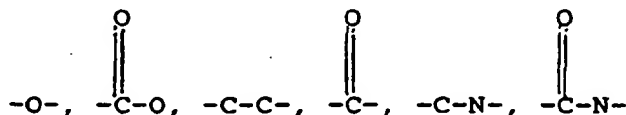
Suitable deflocculating polymer types for use in compositions of the invention are for instance described in our copending European patent application 89201530.6 and in our copending British patent applications 8924479.2, 8924478.4 and 8924477.6.

A preferred class of polymers are biodegradable polymers having a hydrophilic backbone and at least one hydrophobic side chain. The basic structure of polymers having a hydrophilic backbone and one or more hydrophobic side chains is described in EP 89201530.6.

The hydrophilic backbone of the polymer generally is a linear, branched or cross-linked molecular composition containing one or more types of relatively hydrophilic monomer units, possibly in combination with minor amounts of relatively hydrophobic units. The only limitations to the structure of the hydrophilic backbone are that the polymer must be suitable for incorporation in an active-structured aqueous liquid softener composition and the hydrophilic backbone is relatively soluble in water in that the solubility in water of 20°C at a pH of 7.0 is preferably more than 1 g/l, more preferably more than 5 g/l, most preferably more than 10 g/l.

Preferably the hydrophilic backbone is predominantly linear in that the main chain of the backbone constitutes at least 50% by weight, preferably more than 75%, most preferably more than 90% by weight of the backbone.

The hydrophilic backbone is constituted by monomer units, which can be selected from a variety of units available for the preparation of polymers. The polymers can be linked by any possible chemical link, although the following types of linkages are preferred:



Water-soluble monomers suitably employed to form the hydrophilic backbone are for example those which are sufficiently water-soluble to form at least a one weight percent solution when dissolved in water and readily undergo polymerisation to form polymers which are water-soluble at ambient temperature and at a pH of 3.0 to 12.5, preferably more than 1 gram per litre, more preferably more than 5 grams per litre, most preferably more than 10 grams per litre. Exemplary water-soluble monomers include ethylenically unsaturated amides such as acrylamide, methacrylamide and fumaramide and their N-substituted derivatives such as 2-acrylamido-2-methylpropane sulphonic acid, N-(dimethylaminomethyl) acrylamide as well as N-(trimethylammoniummethyl) acrylamide chloride and N-(trimethylammoniumpropyl) methacrylamide chloride; ethylenically unsaturated carboxylic acids or dicarboxylic acids such as acrylic acid, maleic acid, methacrylic acid, itaconic acid, fumaric acid, crotonic acid, aconitic acid and citraconic acid; and other ethylenically unsaturated quaternary ammonium compounds such as vinylbenzyl trimethyl ammonium chloride; sulfoalkyl esters of unsaturated carboxylic acids such as 2-sulphoethyl methacrylate; aminoalkyl esters of unsaturated carboxylic acids such as 2-aminoethyl methacrylate, dimethyl aminoethyl (meth)acrylate, diethyl aminoethyl (meth)acrylate, dimethyl aminomethyl (meth)acrylate, diethyl aminomethyl (meth)acrylate, and their quaternary ammonium salts; vinyl or allyl amines such as vinyl pyridine and vinyl morpholine or allylamine; diallyl amines and diallyl ammonium compounds such as diallyl methyl ammonium chloride; vinyl heterocyclic amides such as vinyl pyrrolidone; vinyl aryl sulphonates such as vinylbenzyl sulphonate; vinyl alcohol obtained by the hydrolysis of vinyl acetate; acrolein; allyl alcohol; vinyl acetic acid; sodium vinyl sulphonate; sodium ally sulphonate, as well as the salts of the foregoing monomers. These monomers may be used singly or as mixtures thereof.

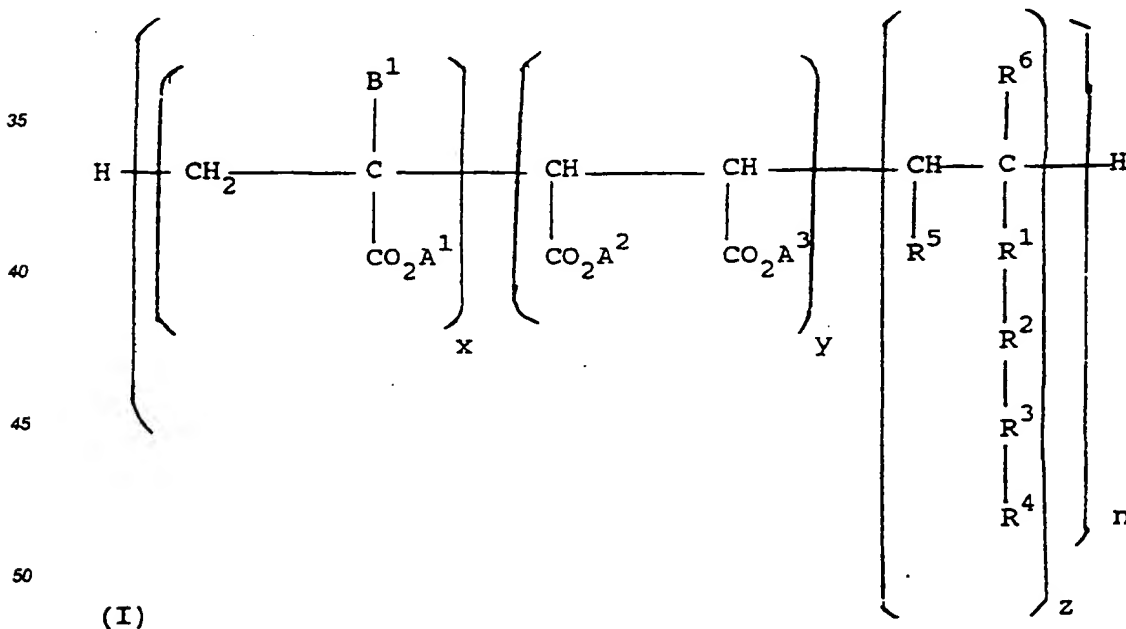
Optionally, the hydrophilic backbone may contain small amounts of relatively hydrophobic units, e.g. those derived from polymers having a solubility of less than 1 g/l in water, provided that the overall solubility of the hydrophilic polymer backbone still satisfies the solubility requirements as specified here above. Examples of relatively water-insoluble polymers are polyvinyl acetate, polymethyl methacrylate, polyethyl acrylate, polyethylene, polypropylene, polystyrene, polybutylene oxide, polypropylene oxide, polyhydroxypropyl acrylate.

Suitable hydrophobic monomers for forming the side chains generally include those which are (1) water-insoluble, i.e. less than 0.2 weight part of the hydrophobic monomer will dissolve in 100 weight parts water and (2) ethylenically unsaturated compounds having hydrophobic moieties. The hydrophobic moieties (when isolated from their polymerisable linkage) are relatively water-insoluble, preferably less than 1 g/l, more preferably less than 0.5 g/l, most preferably less than 0.1 g/l at ambient temperature and a pH of 3.0 to 12.5.

The hydrophobic moieties preferably have at least 3 carbon atoms and are most preferably pendant organic groups having hydrophobicities comparable to one of the following: aliphatic hydrogen groups having at least three carbons such as C₃ to C₅₀ alkyls and cycloalkyls; polynuclear aromatic hydrocarbon groups such as naphthyls; alkylaryls wherein the alkyl groups has one or more carbons; haloalkyls of 3 or more carbons, preferably perfluoroalkyls; polyalkyleneoxy groups wherein alkylene is propylene or high alkylene and there is at least one alkyleneoxy unit per hydrophobic moiety; and siloxane moieties. Exemplary hydrophobic monomers include butyl acrylate, isobutyl acrylate, 2-ethylhexyl acrylate and the corresponding methacrylates, the higher alkyl esters of alpha, beta-ethylenically unsaturated carboxylic acids such as dodecyl acrylate, dodecyl methacrylate, tridecyl acrylate, tridecyl, methacrylate, tetradecylacrylate, octadecyl acrylate, octadecyl methacrylate, octyl half ester of maleic anhydride, dioctyl diethyl maleate, and other alkyl esters and half esters derived from the reactions of alkanols having from 3 to 50 carbon atoms with ethylenically unsaturated carboxylic acids such as acrylic acid, methacrylic acid, maleic anhydride, fumaric acid, itaconic acid and aconitic acid; alkylaryl esters of ethylenically unsaturated carboxylic acid such as nonyl-phenyl acrylate, nonyl-phenyl methacrylate, dodecyl-phenyl acrylate and dodecyl-phenyl methacrylate; N-alkyl, ethylenically unsaturated amides such as N-octadecyl acrylamide; N-octadecyl methacrylamide, N,N-dioctyl acrylamide and similar derivatives thereof, -olefins such as octene-1, decene-1, dodecene-1 and hexadecene-1; vinyl alkylates wherein alkyl has at least 4 carbon atoms such as vinyl laurate and vinyl stearate; vinyl alkyl ethers such as dodecyl vinyl ether and hexadecyl vinyl ether; N-vinyl amides such as N-vinyl lauramide and N-vinyl stearamide; and alkylstyrenes such as t-butyl styrene. The hydrophobic monomer may be used singly or mixtures thereof may be employed. The ratio of hydrophilic to hydrophobic monomers may vary from about 500:1 to 5:1. The weight average molecular weights (Mw.) of the resultant polymers vary from 500 to 500,000 or above when measured by gel permeation chromatography using a polyacrylate standard, or by specific viscosity (SV) measurements using a polyacrylate standard.

Products of the invention preferably comprise polymers of the general formula:

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wherein z is 1; (x+y):z is from 4:1 to 1,000:1; preferably from 6:1 to 250:1 in which the monomer units may be in random order; y being from 0 up to a maximum equal to the value of x; and n is at least 1;

R¹ represents -CO-O-, -O-, -O-CO-, -CH₂-, -CO-NH- OR is absent;

R² represents from 1 to 50 independently selected alkyleneoxy groups, preferably ethylene oxide or propylene oxide groups, or is absent, provided that when R³ is absent and R⁴ represents hydrogen, then R² must

contain an alkyl neoxy group with at least 3 carbon atoms;

R^3 represents a phenylene linkage, or is absent;

R^4 represents hydrogen or a C_{1-24} alkyl or C_{2-24} alkenyl group, with the provisos that:

a) when R^2 is absent, R^4 is not hydrogen and when R^3 is also absent then R^4 must contain at least 5 carbon atoms;

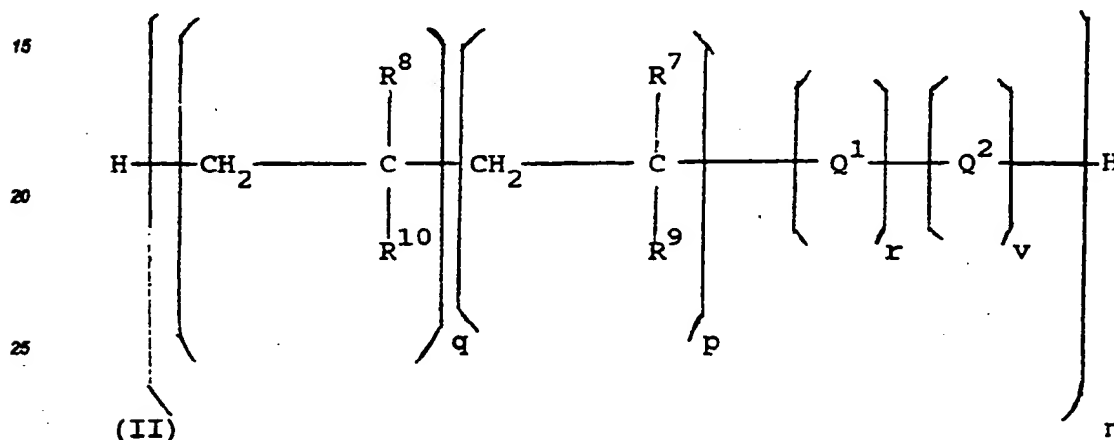
R^5 represents hydrogen or a group of formula $-COOA^4$;

R^6 represents hydrogen or C_{14} alkyl; and

A^1 , A^2 , A^3 and A^4 are independently selected from hydrogen, alkali metals, alkaline earth metals, ammonium and amine bases and C_{1-t} , or $(C_2H_4O)_tH$ wherein t is from 1-50, and wherein the monomer units may be in random order.

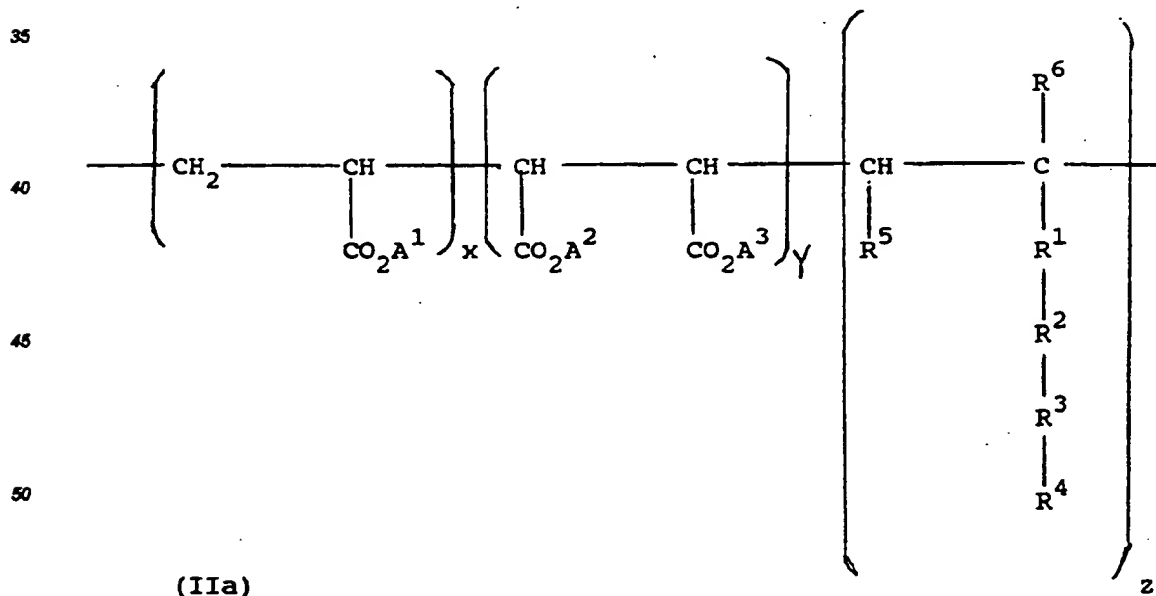
Each B^1 is independently selected from $-CH_2OH$, $-OH$ or $-H$.

Another class of polymers in accordance with the present invention comprises those of formula II:



wherein:

Q^2 is a molecular entity of formula IIa:



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wherein z and R^{1-6} are as defined for formula (I);

A^{1-4} are as defined for formula (I);

Q¹ is a multifunctional monomer, allowing the branching of the polymer, wherein the monomers of the polymer may be connected to Q¹ in any direction, in any order, thereby possibly resulting in a branched polymer. Preferably Q¹ is trimethylolpropane triacrylate (TMPTA), methylene bisacrylamide or divinyl glycol;

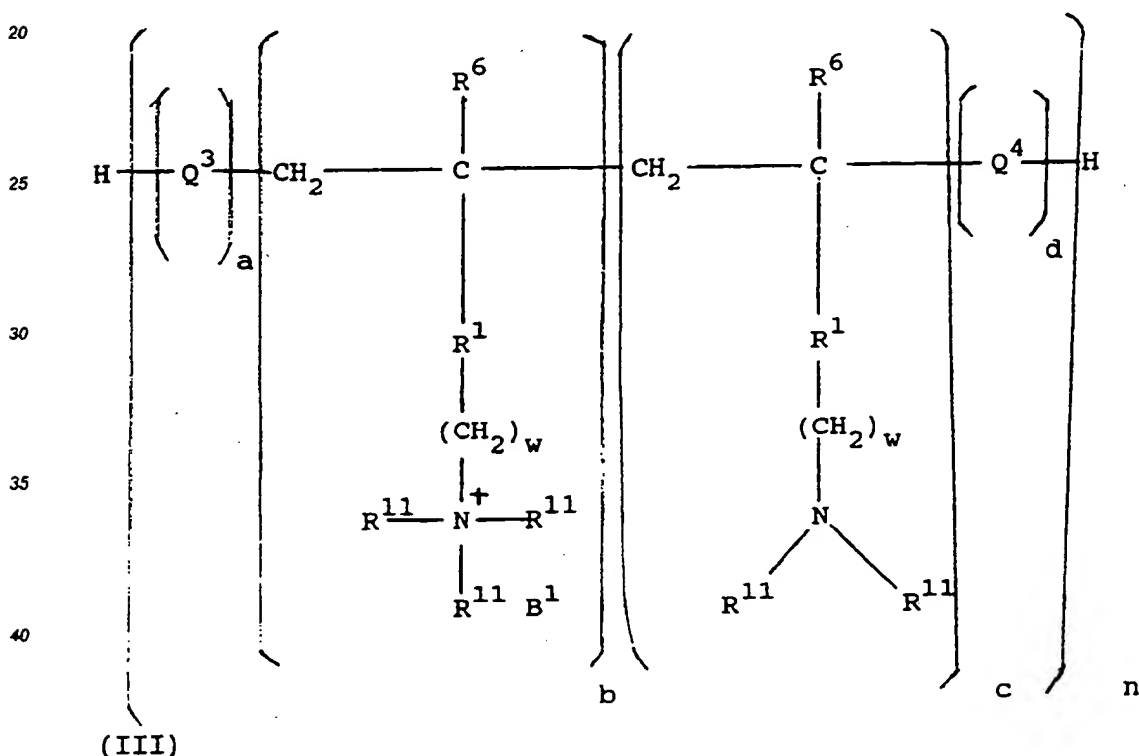
n and z are as defined above; v is 1; and (x + y + p + q + r)z is from 5:1 to 500:1; in which the monomer units may be in random order, and preferably either p and q are zero, or r is zero;

R⁷ and R⁸ represent -CH₃ or -H;

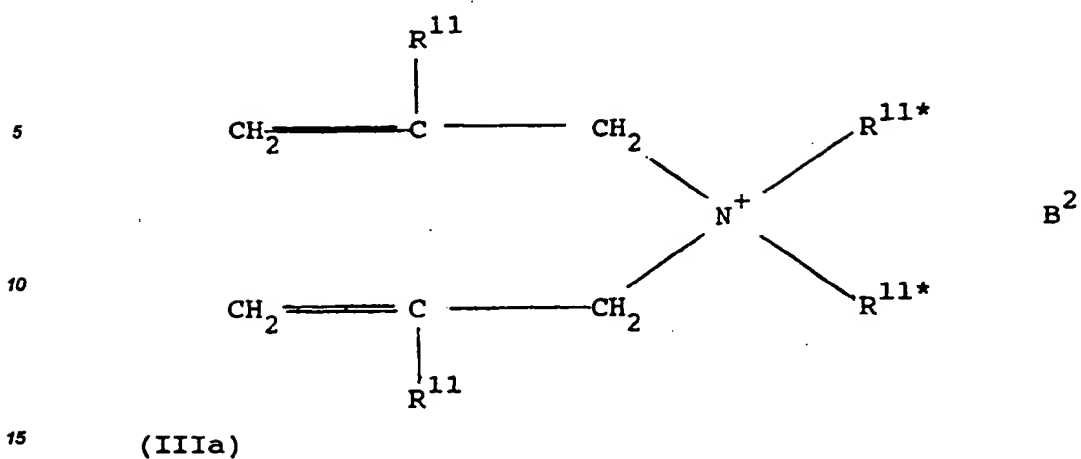
R⁹ and R¹⁰ represent substituent groups such as amino, amine, amide, sulphonate, sulphate, phosphate, phosphonate, hydroxyl, carboxyl and oxide groups, or (C₂H₄O)_tH, wherein t is from 1-50, and wherein the monomer units may be in random order. Preferably they are selected from -SO₃Na, -CO-O-C₂H₄, -OSO₃Na, -CO-NH-C(CH₃)₂-CH₂-SO₃Na, -CO-NH₂, -O-CO-CH₃, -OH. In any particular sample of polymer material in which polymers of formulae I and II are in the form of a salt, usually some polymers will be full salts (A¹-A⁴ all other than hydrogen), some will be full acids (A¹-A⁴ all hydrogen) and some will be part-salts (one or more A¹-A⁴ hydrogen and one or more other than hydrogen).

The salts of the polymers of formulae I and II may be formed with any organic or inorganic cation defined for A¹-A⁴ and which is capable of forming a water-soluble salt with a low molecular weight carboxylic acid. Preferred are the alkali metal salts, especially of sodium or potassium.

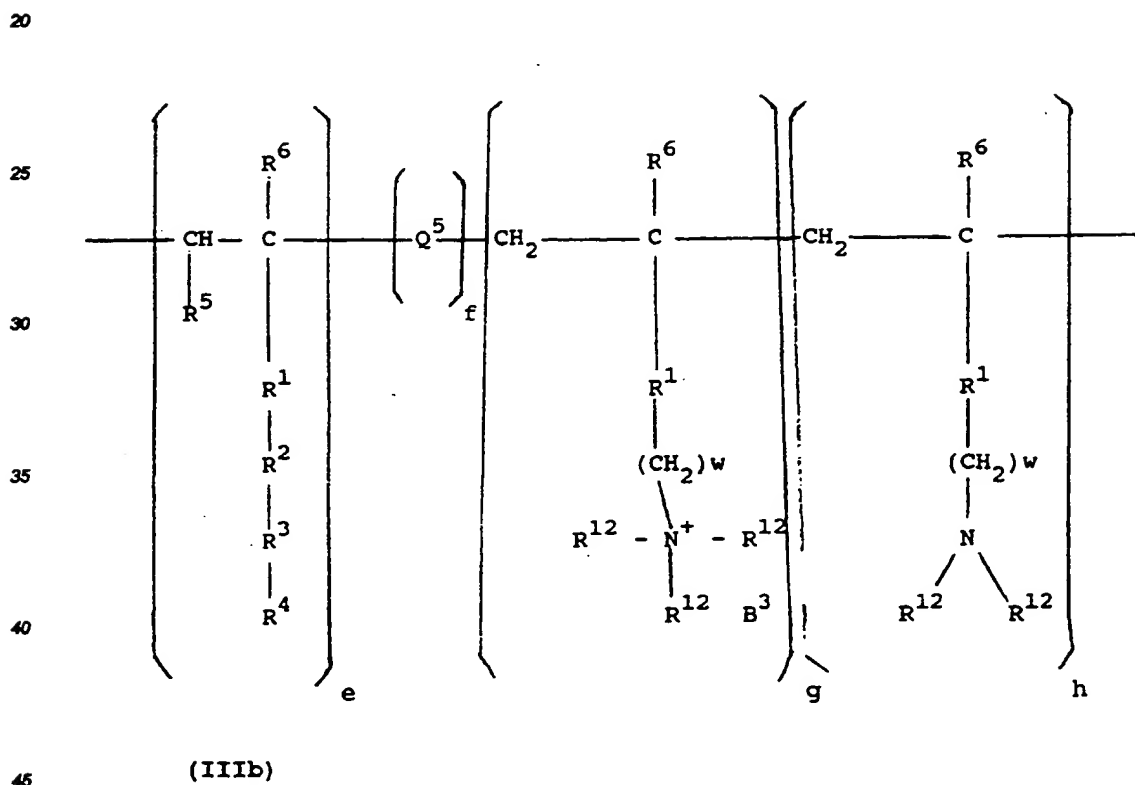
Another class of polymers in accordance with the present invention comprises those of formula III:



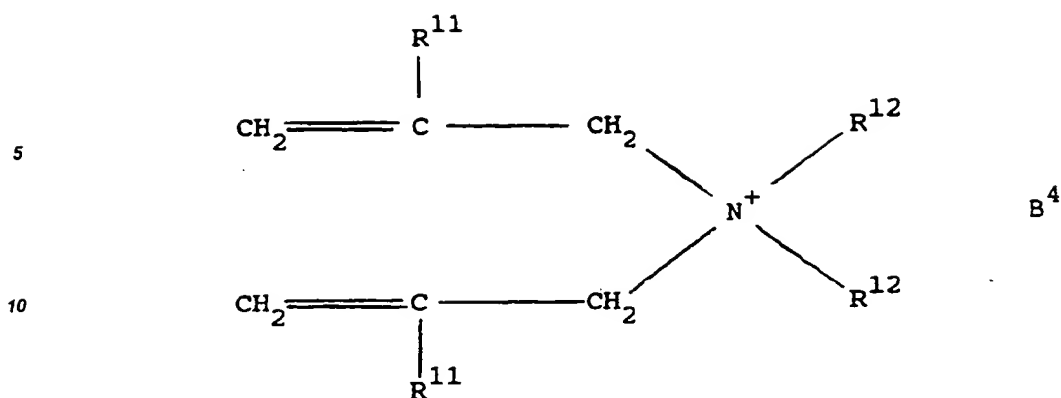
wherein Q³ is derived from a monomeric unit IIIa comprising:



Q⁴ is derived from the molecular entity IIIb:



and Q⁵ is derived from a monomeric unit IIIc:



R¹-R⁶ are defined as in formula I;

(a + b + c): Q⁴ is from 5:1 to 500:1, in which the monomer units may be in random order, a, b, c, d, e, f, g, h may be an integer or zero, n is at least 1;

B¹, B², B³, B⁴ are organic or inorganic anions;

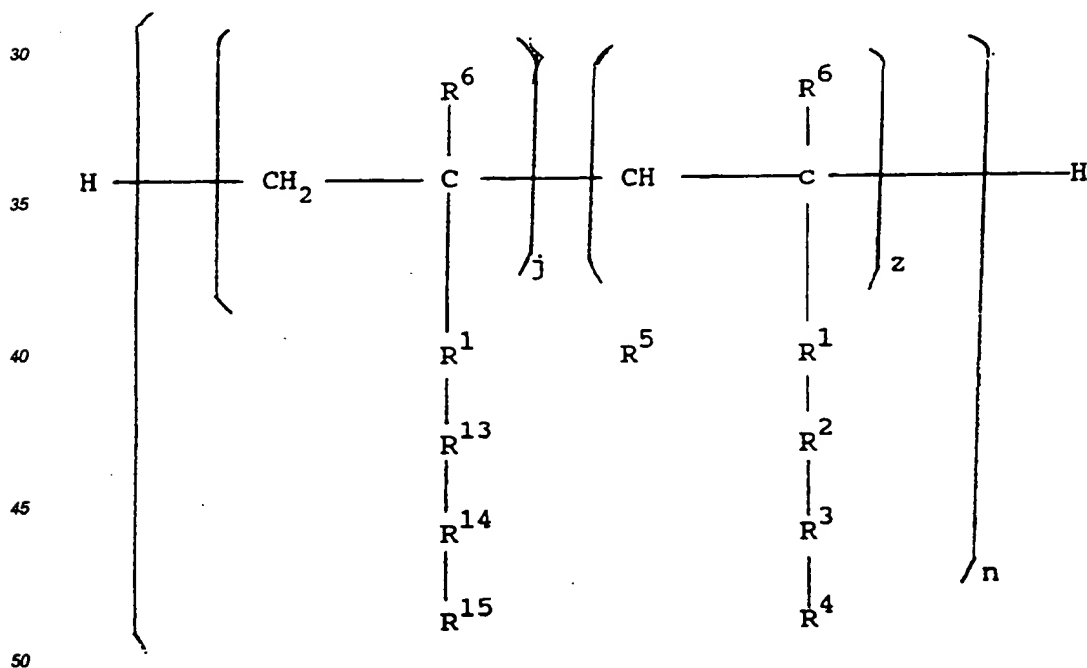
w is zero to 4;

R¹¹ is independently selected from hydrogen or C₁-C₄ alkyl; and

R¹² is independently selected from C₅ to C₂₄ alkyl or alkenyl, aryl cycloalkyl, hydroxyalkyl or alkoxyalkyl.

The anions represented by B¹, B², B³, B⁴ are exemplified by the halide ions, sulphate, sulphonate, phosphate, hydroxide, borate, cyanide, carbonate, bicarbonate, thiocyanate, sulphide, cyanate, acetate and the other common inorganic and organic ions. Preferred anions are chloride and methosulphate.

Another class of polymers in accordance with the present invention comprise those of formula IV



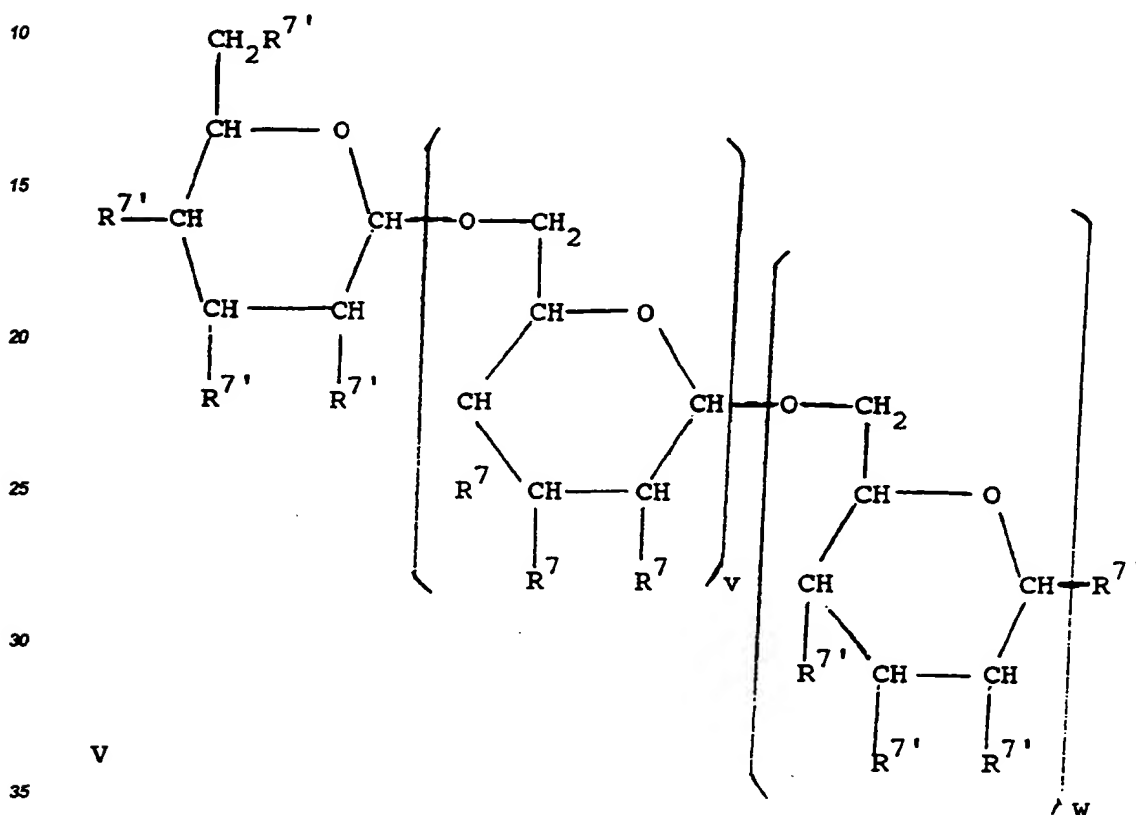
where R¹-R⁶ are defined as in formula I, z is 1 and jz is from 5:1 to 500:1, in which the monomer units may be in random order, and n is at least 1;

R¹³ represents -CH₂-, -C₂H₄-, -C₃H₆- or is absent.

R¹⁴ represents from 1 to 50 independently selected alkyleneoxy groups, preferably ethylene oxide groups, or is absent.

R_{15} represents -OH or hydrogen.

Other preferred polymers are hydrophobically modified polysaccharides. Possible sugar units for use in those polymers include glucosides and fructosides for example maltoses, lactoses, glucoses and galactoses. Also mixtures of sugar groups may be used. The sugar groups may be connected to each other via any suitable linkage, although 1-4 linkages and/or 1-6 linkages are preferred. The polysaccharides are preferably predominantly linear, but also branched polymers may be used. An example of a preferred polysaccharide has the following formula:



Wherein:

Each R^7 is R^7 or $-R^1-R^2-R^3-R^4$;

R^7 is independently selected from -OH, -NH-CO-CH₃, -SO₃A¹, -OSO₃A¹, -NHSO₃A¹, -COOA¹; R^7 is preferably -OH

n is the total number of $-R^1-R^2-R^3-R^4$ groups per molecule;

n is at least 1;

m is the total number of R^7 and $R^{7'}$ groups that are not $-R^1-R^2-R^3-R^4$;

the ratio $m:n$ is from 12:1 to 3,000:1, preferably from 18:1 to 750:1; wherein the monomer units may be in random order. v and w are determined by the molecular weight of the polymer.

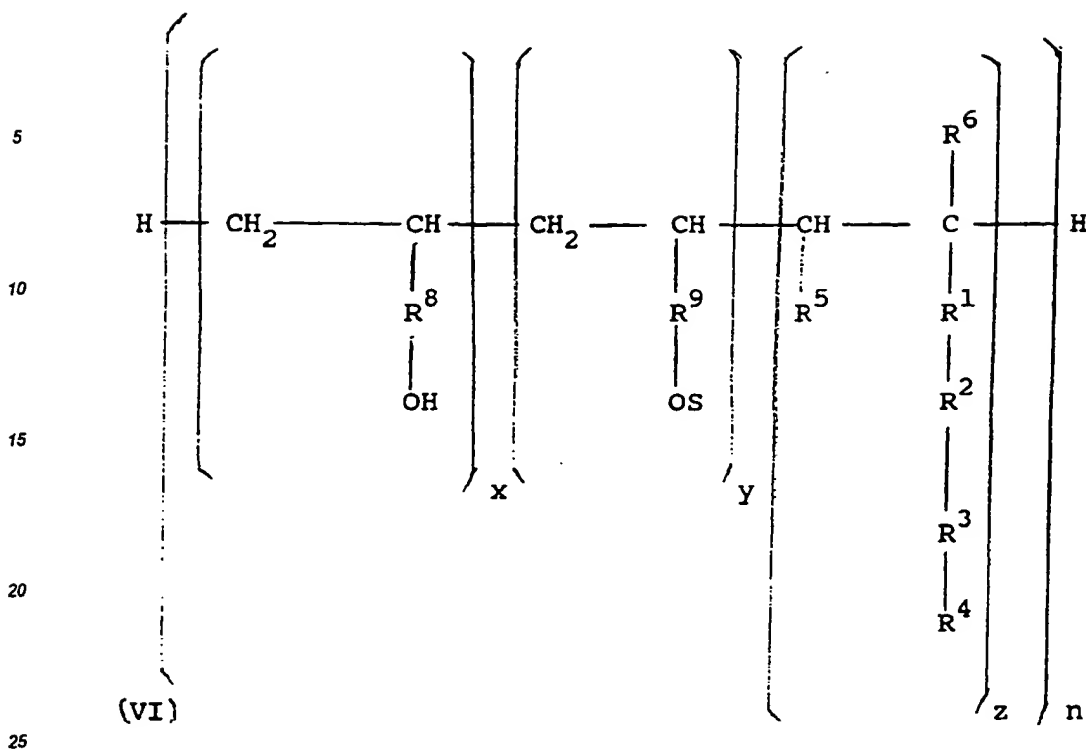
It is believed that on the basis of this formula, the skilled person will be able to derive similar formulas for other polysaccharide polymers for use in compositions of the invention.

R^1 is as defined above for formula I, or can be -NHCO; -OCH₂CONH; or -O-CH₂-CO-O-;

R^{2-4} are as defined for formula I;

A¹ is as defined for formula I.

Other preferred polymers are of the formula:



Wherein:

z and n are as defined for formula I; (x+y): z is from 4:1 to 1,000:1, preferably from 6:1 to 250:1; y preferably being from zero up to a maximum equal to the value of x; wherein the monomer units may be in random order.

30 R¹⁻⁶ are as defined for formula I;

R⁸ and R⁹ represent -CH₂- or are absent;

S is selected from -CO(CH₂)₂COOA¹, -CO(CH₂)₂COOA¹, -COCH₂C(OH)(COOA¹)CH₂COOA¹, -COCH₂COOA¹, -CO(CH(OH))₂COOA¹, -COCH₂CH(OH)COOA¹, -COCH₂CH(CH₃)COOA¹ and -COCH₂C(=CH₂)COOA¹;

A¹ is as defined for formula I;

35 Other preferred polymers as of the formula:



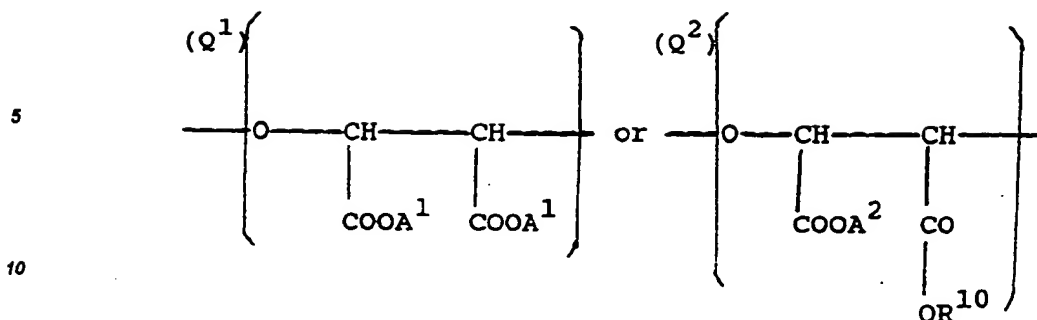
45 Wherein:

D is -H or -OH; n is at least 1;

A is

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Wherein:

- 15 Each A² is A¹ or R¹⁰;
 Q¹:Q² is from 4:1 to 1,000:1, preferably from 6:1 to 250:1;
 R¹⁰ represents a C₅₋₂₄ alk(en)yl group;
 B is



R¹¹ represents -CH₂-, -C₂H₄-, C₃H₆-, or an aryl link said aryl link optionally being substituted with one or more -COOA¹ groups, or a benzophenone link;

25 A¹ is as defined in formula I.

For the polymers of formula I, II and IV and their salts, it is preferred to have a weight average molecular weight in the region of from 500 to 500,000, preferably from 1000 to 200,000 more preferably from 1500 to 50,000, even more preferably from 3,000 to 6,000 when measured by GPC using polyacrylate standards. For the purposes of this definition, the molecular weights of the standards are measured by the absolute intrinsic viscosity method described by Noda, Tsuge and Nagasawa in Journal of Physical Chemistry, Volume 74, (1970), pages 710-719.

It is difficult to determine accurately the molecular weight distribution of polymers of Formula III, because of the highly cationic nature of these polymers and subsequently adsorption on the GPC columns. Instead, a measure of molecular weight can be made by measuring a standard viscosity (S.V.), determined at 15.0% solids, 23°C in a 1.0 molar sodium chloride solution using a Brookfield Synchro-lectric[®] viscometer, Model LVT with an LCP adaptor, at a speed of 60 RPM. It is preferred to have a polymer with an S.V. from 1 to 100 mPas, more preferably from 2-50 mPas, most preferably 3-25 mPas.

Polymers according to formulas V-VII preferably have a molecular weight of 500-250,000, more preferably from 2,000 to 50,000, even more preferably from 3,000 to 6,000.

40 Preferably the polymers for use in compositions of the present invention are prepared by the method as described in UK Patent application No. 8813966.2.

Generally, the deflocculating polymer will be used at from 0.01% to 5.0% by weight in the composition, preferably from 0.02 to 2.0%, most preferably from 0.03 to 1%.

45 Compositions of the present invention preferably comprise from 1 to 80%, by weight of fabric-softening materials, more preferably from 2 to 70% by weight, most preferably from 5 to 50% by weight of the composition. The fabric softening materials may be selected from cationic, nonionic, amphoteric or anionic fabric softening material.

Suitable amphoteric fabric-conditioning materials for use in a composition according to the invention are fabric-substantive amphoteric materials forming a particulate dispersion at a concentration of less than 1 g/l at at least one temperature between 0 and 100°C, preferably at least one temperature between 10 and 90°C, more preferably between 20 and 80°C. For the purpose of this invention a fabric-substantive amphoteric material is preferably an amphoteric or zwitterionic tertiary or quaternary ammonium compound having either one single long hydrocarbyl side chain or two long hydrocarbyl chains. From these compounds the use of amphoteric or zwitterionic ammonium compounds having two long hydrocarbyl chains is particularly preferred for many reasons including costs, ease of processing and better stability and performance. Suitable amphoteric materials are for example disclosed in EP 236 213.

In this specification the expression hydrocarbyl chain refers to linear or branched alkyl or alkenyl chains

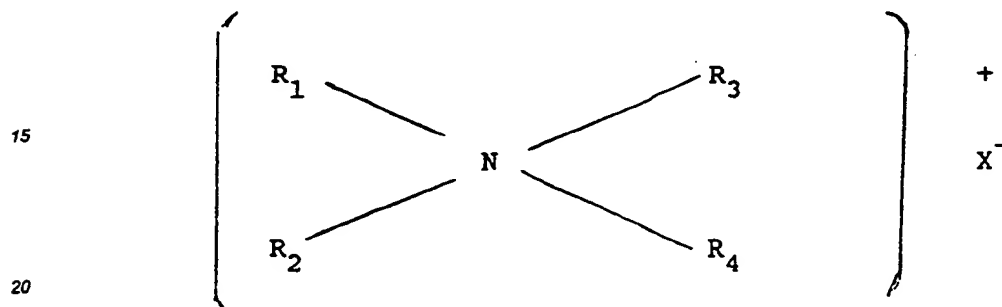
optionally substituted or interrupted by functional groups such as -OH, -O-, -CONH-, -COO-, etc.

Preferably the amphoteric fabric-substantiv materials are water insoluble and have a solubility in water at pH 2.5 at 20°C of less than 10 g/l. The HLB of the amphoteric fabric-substantiv material is preferably less than 10.0.

5 Suitable cationic fabric-softener materials for use in a composition according to the present invention are cationic materials which are water-insoluble in that the material has a solubility in water at pH 2.5 and 20°C of less than 10 g/l. Highly preferred materials are cationic quaternary ammonium salts having two C₁₂-C₂₄ hydrocarbyl chains.

Well-known species of substantially water-insoluble quaternary ammonium compounds have the formula:

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wherein R₁ and R₂ represent hydrocarbyl groups from about 12 to about 24 carbon atoms; R₃ and R₄ represent hydrocarbyl groups containing from 1 to about 4 carbon atoms; and X is an anion, preferably selected from halide, methosulphate and ethyl sulphate radicals.

25

Representative examples of these quaternary softeners include ditallow dimethyl ammonium chloride; ditallow dimethyl ammonium methyl sulphate; dihexadecyl dimethyl ammonium chloride; di(hydrogenated tallow) dimethyl ammonium methyl sulphate; dihexadecyl diethyl ammonium chloride; di(coconut) dimethyl ammonium chloride. Ditallow dimethyl ammonium chloride, di(hydrogenated tallow) dimethyl ammonium chloride, di(coconut) dimethyl ammonium chloride and di(coconut) dimethyl ammonium methosulphate are preferred.

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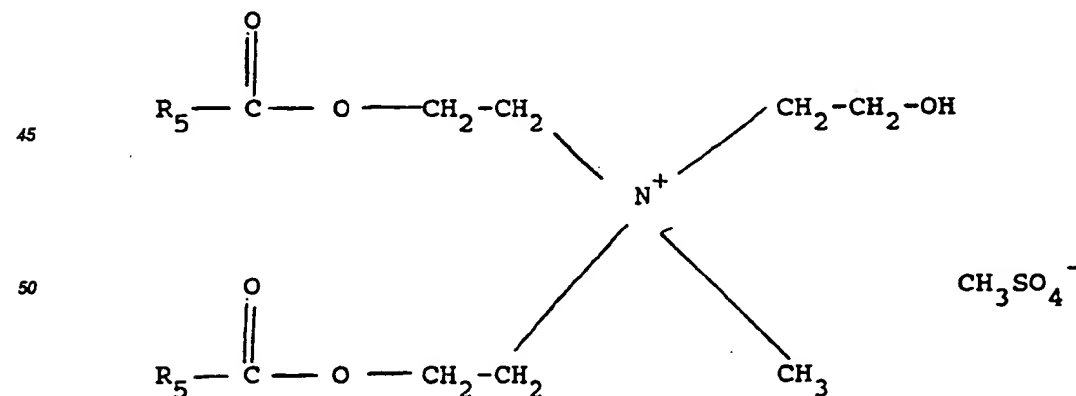
Suitable materials also include dialkyl ethoxyl methyl ammonium methosulphate based on soft fatty acid, dialkyl ethoxyl methyl ammonium methosulphate based on hard fatty acid, and a material in which R₃ and R₄ represent methyl, R₁ is C₁₃₋₁₅, R₂ is CH₂CH₂OCOR, where R is stearyl, and X is methosulphate. Ditallow dimethyl ammonium chloride, di(hydrogenated tallow alkyl) dimethyl ammonium chloride, di(coconut alkyl) dimethyl ammonium chloride and di(coconut alkyl) dimethyl ammonium methosulfate are preferred.

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Other preferred cationic compounds include those materials as disclosed in EP 239 910 (P&G), which is included herein by reference.

Other preferred materials are the materials of formula:

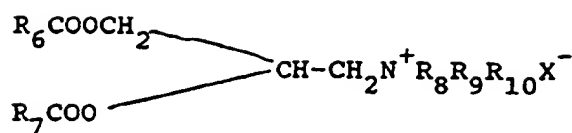
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R₅ being tallow, which is available from Stepan under the trade name Stepanex VRH 90, and

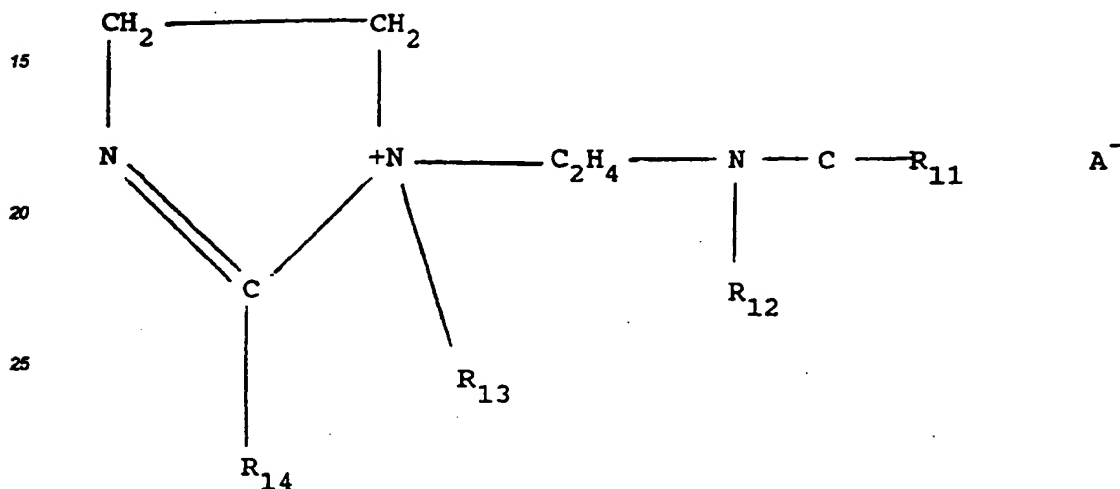


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where R_8 , R_9 and R_{10} are each alkyl or hydroxyalkyl groups containing from 1 to 4 carbon atoms, or a benzyl group. R_6 and R_7 are each an alkyl or alkenyl chain containing from 11 to 23 carbon atoms, and X^- is a water-soluble anion. These materials and their method of preparation are described in US 4 137 180 (LEVER BROTHERS).

10

Another class of preferred water-insoluble cationic materials are the hydrocarbylimidazolinium salts believed to have the formula:



25

wherein R_{13} is a hydrocarbyl group containing from 1 to 4, preferably 1 or 2 carbon atoms, R_{11} is a hydrocarbyl group containing from 8 to 25 carbon atoms, R_{14} is an hydrocarbyl group containing from 8 to 25 carbon atoms and R_{12} is hydrogen or an hydrocarbyl containing from 1 to 4 carbon atoms and A^- is an anion, preferably a halide, methosulphate or ethosulphate.

30

Preferred imidazolinium salts include 1-methyl-1-(tallowylamido-) ethyl -2-tallowyl- 4,5-dihydro imidazolinium methosulphate and 1-methyl-1-(palmitoylamido) ethyl -2-octadecyl-4,5- dihydroimidazolinium chlorid . Other useful imidazolinium materials are 2-heptadecyl-1-methyl-1- (2-stearylamo)ethyl-imidazolinium chloride and 2-lauryl-1-hydroxyethyl-1-oleyl-imidazolinium chloride. Also suitable herein are the imidazolinium fabric-softening components of US patent No. 4 127 489, incorporated by reference.

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Representative commercially available materials of the above classes are the quaternary ammonium compounds Arquad 2HT (Ex AKZO); Noranium M2SH (ex CECA); Aliquat-2HT (Trade Mark of General Mills Inc), Stepanex Q185 (ex Stepan); Stepanex VP85 (ex Stepan); Stepanex VRH90 (ex Stepan); Synprolam FS (ex ICI) and the imidazolinium compounds Varisoft 475 (Trade Mark of Sherex Company, Columbus Ohio) and Rewoquat W7500 (Trade Mark of REWO).

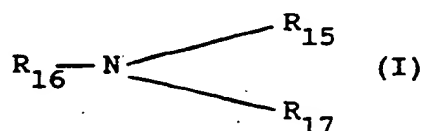
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The compositions according to the invention may also contain, possibly in addition to the above mentioned softening agents, one or more amine softening materials.

The term "amine" as used herein can refer to

(i) amines of formula:

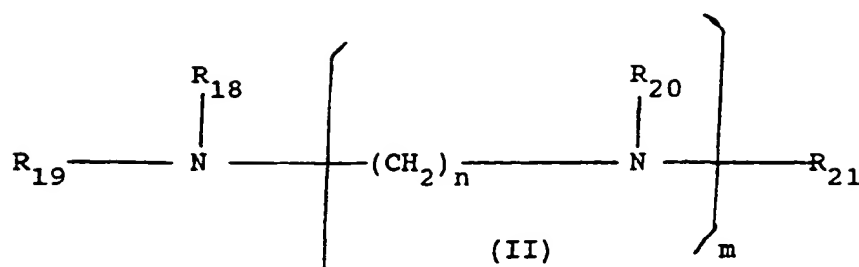
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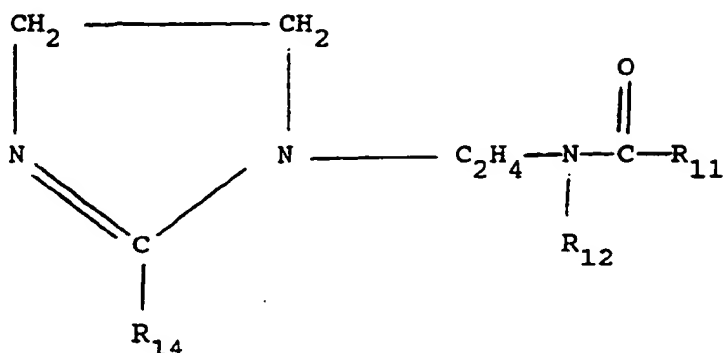
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wherein R_{15} , R_{16} and R_{17} are defined as below;

(ii) amines of formula:



wherein R_{18} , R_{19} , R_{20} and R_{21} , m and d are defined as below.
 (iii) imidazolines of formula:



wherein R_{11} , R_{12} and R_{14} are defined as above.

(iv) condensation products formed from the reaction of fatty acids with a polyamine selected from the group consisting of hydroxy alkylalkylenediamines and dialkylenetriamines and mixtures thereof. Suitable materials are disclosed in European Patent Application 199 382 (Procter and Gamble), incorporated herein by reference.

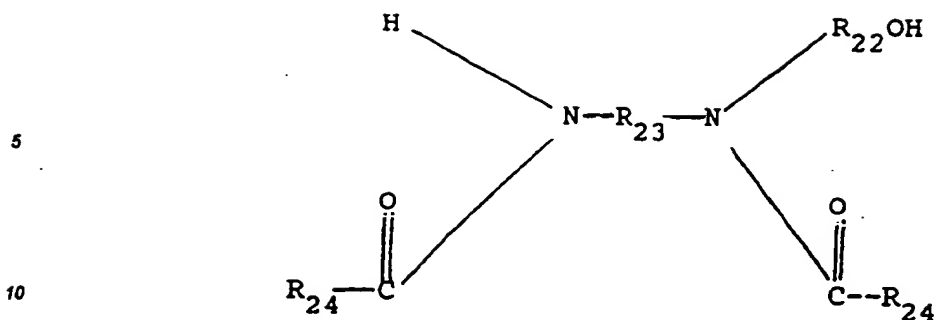
When the amine is of the formula I above, R_{15} is a C_6 to C_{24} hydrocarbyl group, R_{16} is a C_1 to C_{24} hydrocarbyl group and R_{17} is a C_1 to C_{10} hydrocarbyl group. Suitable amines include those materials from which the quaternary ammonium compounds disclosed above are derived, in which R_{15} is R_1 , R_{16} is R_2 and R_{17} is R_3 . Preferably, the amine is such that both R_{15} and R_{16} are C_6 - C_{20} alkyl with C_{16} - C_{18} being most preferred and with R_{17} as C_{1-3} alkyl, or R_{15} is an alkyl or alkenyl group with at least 22 carbon atoms and R_{16} and R_{17} are C_{1-3} alkyl. Preferably these amines are protonated with hydrochloric acid, orthophosphoric acid (OPA), C_{1-6} carboxylic acids or any other similar acids, for use in the fabric-conditioning compositions of the invention.

When the amine is of formula II above, R_{18} is a C_6 to C_{24} hydrocarbyl group, R_{19} is an alkoxyated group of formula $-(\text{CH}_2\text{CH}_2\text{O})_y\text{H}$, where y is within the range from 0 to 6, R_{20} is an alkoxyated group of formula $-(\text{CH}_2\text{CH}_2\text{O})_z\text{H}$ where z is within the range from 0 to 6 and m is an integer within the range from 0 to 6, and is preferably 3. When m is 0, it is preferred that R_{18} is a C_{16} to C_{22} alkyl and that the sum total of z and y is within the range from 1 to 6, more preferably 1 to 3. When m is 1, it is preferred that R_{18} is a C_{16} to C_{22} alkyl and that the sum total of x and y and z is within the range from 3 to 10.

Representative commercially available materials of this class include Ethomeen (ex Armour) and Ethoduo-meen (ex Armour).

Preferably the amines of type (ii) or (iii) are also protonated for use in the fabric-conditioning compositions of the invention.

When the amine is of type (iv) given above, a particularly preferred material is:



where R_{22} and R_{23} are divalent alkenyl chains having from 1 to 3 carbon atoms, and R_{24} is an acyclic aliphatic hydrocarbon chain having from 15 to 21 carbon atoms. A commercially available material of this class is Ceranine HC39 (ex Sandoz).

The compositions also contain an emulsion component such as hydrocarbons, perfumes, natural fats and oils, fatty acids and/or esters thereof, fatty alcohols and silicones.

Highly preferred hydrocarbons are paraffins and olefines but alkynes and halogenated paraffins such as myristyl chloride are not excluded. Materials known generally as paraffin oil, soft paraffin wax, petroleum and petroleum jelly are especially suitable. Examples of specific materials are tetradecane, hexadecane, octadecane and octodecene.

Preferred perfumes are Portia 40 ex IFF Ltd, LFU 384 ex Quest and Cocoon SN3000 ex Givaudan.

Examples of natural oils are coconut, corn, olive and sunflower as well as naturally occurring waxy solids such as lanolin. Examples of animal fats are butter, tallow and sardine.

Preferred fatty acids and esters are lauric, myristic, palmitic and stearic acids, methyl laurate, ethyl myristate, ethyl stearate, methyl palmitate and ethylene glycol monostearate. Examples of fatty alcohols include decanol, dodecanol, tetradecanol, pentadecanol, hexadecanol and lauryl and palmityl alcohols. Examples of esters include isopropylmyristate.

Examples of silicones and aminosilicones suitable for use in the invention are disclosed in DE 2 631 419 (Procter and Gamble/Dumbrell) and those supplied commercially as VP 1487E ex Wacker and the Magnasoft range ex Union Carbide.

We have found that deposition of the emulsion component is improved when the particles are positively charged. When a cationic fabric softener is used it is convenient to make the fabric treatment composition in a one-stage process where the fabric softener acts as emulsifier. When this is not possible it may be necessary to make the emulsion separately in which case a separate emulsifier may be required. Suitable emulsifiers are single or di-alkyl ammonium salts, the esters of sorbitan, glycerol or polyethylene glycol and ethoxylated alcohols.

The levels of emulsion component in the composition is typically from 1 to 80%, by weight preferably from 2 to 70% and most preferably from 5 to 50%. The compositions according to the invention may optionally contain electrolyte. The level of dissolved electrolyte is typically from 0% to 0.2%, preferably 0.05 to 0.2%.

Compositions according to the present invention preferably have a pH of less than 6.0, more preferred less than 5.0, especially from 1.5 to 4.5, most preferred from 2.0 to 4.0.

The compositions can also contain one or more optional ingredients selected from non-aqueous solvents such as C_1 - C_4 alkanols and polyhydric alcohols, pH-buffering agents such as weak acids, e.g. phosphoric, benzoic or citric acids, re-wetting agents, viscosity modifiers, aluminium chlorohydrate, antigelling agents, fluorescent, colourants, hydrotropes, antifoaming agents, antiredeposition agents, enzymes, optical brightening agents, opacifiers, stabilisers such as guar gum and polyethylene glycol, anti-shrinking agents, antioxidants, anti-corrosion agents, preservatives such as Bronopol (Trade Mark), a commercially available form of 2-bromo-2-nitropropane-1,3-diol, to preserve the fabric treatment composition, dyes, bleaches and bleach precursors, drape-imparting agents, antistatic agents and ironing aids.

These optional ingredients, if added, are each present at levels up to 5% by weight of the composition.

The invention will be further illustrated by means of the following examples.

Examples

In Examples I-II the following polymers were used. Each polymer was obtained from National Starch as an aqueous solution of from 30-60% by weight solids level. All percentages for the polymer refer to 100% active polymers.

Basic Structures of Polymers: General Formula IIwherein $R^8 = H$, $r = O$, $v = 1$ wherein Q^2 ; $x = y = O$, $R^1 = COO$, R^3 absent, $R^5 = H$, $R^6 = CH_3$.

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Polymer Ref	R^{10}	q	R^7	R^9	p	R^4	SV (cps)
435/173	$COOC_2H_4OH$	25	-	-	O	$C_{12}H_{25}$	3.5
435/174	$COOC_2H_4OH$	25	-	-	O	$C_{12}H_{25}$	4.3
448/20	$COOC_2H_4OH$	10	-	-	O	$C_{12}H_{25}$	-

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Basic Structure of Polymers: General Formula IIIwherein $b = c = O$, $R^4 = -C_{12}H_{25}$, $R^6 = CH_3$, $d = 1$. In IIIa, $R^{11} = H$, $R^{11*} = CH_3$, $B^2 = C^1$. In IIIb, $e = 1$, $f = g = h = i = O$, $R^1 = COO$, R^3 is absent, $R^5 = H$, $B^3 = C^1$.

20

Polymer Ref	a	d	R^4	R^6	SV (cps)
433/20	10	1	$C_{18}H_{37}$	CH_3	5.5
442/25	10	1	$C_{12}H_{25}$	CH_3	4.6
442/44	10	1	$C_{12}H_{25}$	CH_3	6.3
442/60	10	1	C_8H_{17}	H	-

30

Example 1

Fabric softening compositions were made by adding the deflocculating polymer under stirring, to a preheated (70°C) mixture of the emulsion component and fabric softening material in aqueous dispersion. The fabric softening material was Arquad 2HT (a dimethyl ditallow ammonium chloride) ex Atlas. The emulsion component was a combination of Sirius M85 a mineral oil ex Dalton & Co., Silkolene 910 ex Dalton & Co., a petroleum jelly and optionally lanolin.

The following compositions were obtained:

<u>Component</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
	<u>% by weight</u>					
Arquad 2HT	4.25	4.25	4.25	4.25	9	9
Sirius M85	10.70	10.70	10.70	10.70	24	24
Silkolene 910	5.30	5.30	5.30	5.30	12	12
Lanolin	2.0	2.0	3.0	3.0	-	-
Polymer 433/20	-	0.13	-	0.09	-	0.1
Water	- - - - -	- - - - -	balance	- - - - -	- - - - -	- - - - -

55

In all compositions B, D and F a significant reduction in viscosity was observed when compared to that of the corresponding composition without polymer. In compositions E and F a reduction in viscosity from 0.7 Pas to 0.3 Pas was measured at a shear rate of $21s^{-1}$.

Exempl II

Fabric softening compositions were made according to the method of Example I. The fabric softening material was either Arquad 2HT as used in Example I or Arquad 2T ex Atlas. In Arquad 2T the tallow is not hardened.

<u>Component</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
	<u>% by weight</u>			
Arquad 2HT	7	7	-	-
Arquad 2T	-	-	7	7
Sirius M85	18.7	18.7	18.7	18.7
Silkolene 910	9.3	9.3	9.3	9.3
Polymer 435/174	-	0.27	-	0.3
Water	- - - - -	balance	- - - - -	- - - - -
Viscosity mPas	2952	338	729	182
110s ⁻¹				
21s ⁻¹	14721	709	3458	404

Example III

-Fabric softening compositions were made according to the method of Example I excepting that the electrolyte (when present) was added along with the polymer.

<u>Component</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>
Arquad 2HT	7	7	7	7	7
Sirius M85	18.7	18.7	18.7	18.7	18.7
Silkolene 910	9.3	9.3	9.3	9.3	9.3
Polymer 435/173	0.3	0.3	0.3	0.3	0.3
NaCl	-	0.05	0.1	0.15	0.2
Water	- - - - -	balance	- - - - -	- - - - -	- - - - -
Viscosity mPas					
110s ⁻¹	210	65	125	160	295
21s ⁻¹	658	473	431	616	879

From comparison with Example IIA it can be seen that a reduction in viscosity from 14.7 Pas to 0.6 Pas occurs on addition of the deflocculating polymer. The addition of electrolyte (Example IIIB) then reduces this viscosity further. Continued addition of electrolyte however leads eventually to a viscosity increase.

Example IV

A typical formulation for use as a rinse conditioner comprises:

% by weight

5	Arquad 2HT	7
	Sirius M85	18.7
	Silkolene 910	9.3
	Lanolin	0.5
10	Polymer 442/25	0.04
	Water	to balance

This composition has a viscosity at $21s^{-1}$ of 0.44 Pas.

Example V

Fabric softening compositions were made according to the method of Example I. The fabric softening material was Rewoquat W75 (a 1-methyl-1 (tallowylamido-) ethyl-2-tallowyl-4,5-dihydroimidazolinium methosulphate).

25	<u>Component</u>	<u>Composition</u>					
		<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
	Rewoquat W75	16	16	16	16	16	16
	Sirius M85	1	2	2	1	2	2
30	CaCl ₂	0.01	0.01	0.01	0.01	0.01	0.01
	Polymer 442/44	-	-	-	-	0.43	-
	Polymer 442/60	-	-	0.36	0.5	-	-
35	Polymer 448/20	-	-	-	-	-	0.4
	Water	-----balance-----					

Viscosity mPas

40	$21s^{-1}$	86	756	79	40	122	253
	$110s^{-1}$	45	122	43	26	49	121

45 In compositions C, D, E and F a significant reduction in viscosity was observed when compared to that of the corresponding composition without polymer. For example composition A compared to composition D or composition B compared to compositions C, E or F.

Example VI

50 Fabric softening compositions were made according to the method of Example I.

55

	<u>Component</u>	<u>Compositions</u>			
		<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
5	Rewoquat W75	16	16	16	16
	Sirius M85	3	3	3	3
10	CaCl ₂	0.01	0.01	0.01	0.01
	Polymer 442/44	-	0.36	-	-
	Polymer 442/60	-	-	0.47	-
15	Polymer 448/20	-	-	-	0.40
	Water	-----balance-----			

	<u>Viscosity mPas</u>				
20	21s ⁻¹	907	160	80	289
	110s ⁻¹	282	60	37	125

25 In compositions B, C and D a significant reduction in viscosity was observed when compared to that of the corresponding composition without polymer (A).

30 Example VII

Fabric softening compositions were made according to the method of Example I.

	<u>Component</u>	<u>Composition</u>		
		<u>A</u>	<u>B</u>	<u>C</u>
35	Rewoquat W75	16	16	16
40	Steric Acid	2	2	2
	CaCl ₂	0.025	0.025	0.025
	Polymer 442/44	-	0.39	-
45	Polymer 442/60	-	-	0.36
	Water	-----balance-----		

	<u>Viscosity mPas</u>			
50	21s ⁻¹	1283	325	215
	110s ⁻¹	475	129	101

55 In compositions B and C a significant reduction in viscosity was observed when compared to that of the corresponding compositions without polymer (A).

Example VIII

Fabric softening compositions were made according to the method of Example I.

5	<u>Component</u>	<u>Composition</u>				
		<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
10	Rewoquat W75	15	15	15	15	
	Octadecane	12	12	12	12	
	Polymer 442/44	-	0.89	-	-	
15	Polymer 442/60	-	-	0.36	-	
	Polymer 448/20	-	-	-	0.40	
	Water	-----balance-----				
20	<u>Viscosity mPas</u>					
	21s ⁻¹	5853	1760	1614	1891	
25	110s ⁻¹	1016	453	482	496	

In compositions B, C and D a significant reduction in viscosity was observed when compared to that of the corresponding composition without polymer (A).

Claims

1. A fabric treatment composition comprising an aqueous base, one or more, fabric-softening materials and an emulsion component, said composition having a structure of lamellar droplets of the fabric-softening material in combination with an emulsion, said composition also comprising a deflocculating polymer comprising a hydrophilic backbone and one or more hydrophobic side chains.
2. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of the general formula (I) as defined herein.
3. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of the general formula (II) as defined herein.
4. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of the general formula (III) as defined herein.
5. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of the general formula (IV) as defined herein.
6. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of the general formula (V) as defined herein.
7. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of general formula (VI) as defined herein.
8. A fabric treatment composition as claimed in claim 1 wherein the deflocculating polymer is of general formula (VII) as defined herein.

9. A fabric treatment composition according to any of the preceding claims wherein the composition comprises from 0.01 to 5% by weight of deflocculating polymer.
10. A fabric treatment composition according to any of the preceding claims wherein the softener material comprises a cationic fabric softening material.
11. A fabric treatment composition according to any of the preceding claims wherein the emulsion component comprises hydrocarbons.
12. A fabric treatment composition according to any of the preceding claims wherein the emulsion component comprises a perfume.
13. A fabric treatment composition according to any of the preceding claims having a pH of less than 6.0.